Fertilizing Field Pea and Lentil

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Field pea and lentil are two legumes grown in the region as a high protein crop for livestock feed and human consumption.

Acreage of field pea has increased recently, with the trend expected to continue as traditional wheat producers search for rotational crops that will decrease marketing risk, decrease the risk of certain diseases and insects, and increase the quality of soil in their fields.

Acreage of lentil remained stable from 1993 to 1996 at about 9,000 acres per year in North Dakota.

Nitrogen requirement and inoculation

Although some yield response of pea and lentil can be seen with high rates of nitrogen supplements, usually little additional nitrogen is required if the seed is treated with the proper inoculum. Inoculate lentil with the lentil strain of *Rhizobium leguminosarum* and field pea with the pea strain of *Rhizobium leguminosarum*. Studies have shown that from 60 to 80% of the N in field pea comes from nitrogen fixation. The remainder may come from soil organic matter/residue mineralization or nitrogen fertilizer.

In a soil fertility trial at Carrington in 1995, beginning soil test levels were 20 lb of NO_3-N in the surface 0-2 foot depth. Treatments and results are detailed in Table 1.

Table 1. Effect of inoculation and N rates on yield and protein of field pea.

Treatment	Seed Protein, %	Yield, lb/acre	Yield, % of Check
No inoculum, 0 N	20.4	2064	100
Nitrogin® inoculum	20.6	2930	142
Sowfast® inoculum	21.0	2705	131
Sowfast® + 20 lb N/acre	20.6	2988	145
Sowfast® + 50 lb N/acre	19.5	3198	155
90 lb/acre N only	19.0	3024	146
35 lb/acre N only	18.4	2475	120
Sowfast® + 20 lb/acre N + 40 lb/acre Sulfur	21.3	2981	144
LSD 0.05	1.2	393	19

Inoculation significantly improved yields. Differences between inoculation treatments were not significant. The 90 lb/acre N rate gave yields similar to inoculated treatments.

Generally, inoculation is less expensive than nitrogen fertilizer and supplemental nitrogen fertilizer would not be encouraged in most fields.

Phosphate fertilizer and placement

Field pea and lentil respond to P fertilization. P rates depend on soil test levels and yield goals (Table 2). Yield goals are determined by looking at past field histories, or if the crop is new to a production area, consulting with an agronomist or a producer in the North Dakota Pea and Lentil Association may give some insight into what a practical yield expectation is.

Table 2. Phosphorus (P) and potassium (K) recommendations for field pea and lentil.

		Soil test P, ppm					Soil test K, ppm				
		VL	L	M	H	VH	VL	L	M	H	VH
Yield	Bray P1	0-5	6-10	11-15	16-20	20+					
Goal	Olsen	0-3	4-7	8-11	12-15	16+	0-40	41-80	81-120	121-160	161+
lb/acre		lb P_2O_5/acre					lb K_2O/acre				
1400		20	15	10	0	0	35	25	15	0	0
1800		30	20	10	0	0	45	30	20	0	0
2200		35	25	15	0	0	55	40	25	10	0
2600		40	30	15	0	0	65	45	30	10	0

Bray P1 recommendation=(0.01710-0.00085 STP) X YG
Olsen P recommendation=(0.01710-0.0011 STP) X YG
Potassium recommendations=(0.03000-0.00018 STK) X YG

The abbreviations used in the equations are as follows:
YG=yield goal
STP=soil test P
STK=soil test K

Phosphate may be broadcast, but increased yields have been seen when P is sidebanded or banded with the seed. When fertilizing in a band application, the amount of P recommended at very low (VL) and low (L) soil P levels can be decreased by one-third. At medium or higher levels, P rates should remain as shown in Table 2.

The limit to P fertilizer applied in the seed band is about 20 lb /acre P_2O_5 as MAP (monoammonium phosphate, also designated as 11-52-0, or 10-50-0). DAP (diammonium phosphate, also designated 18-46-0) is often too "hot" for germinating pea and lentil seeds and young seedlings, so it should be avoided, as should other nitrogen containing fertilizers. MAP, although it contains nitrogen, is somewhat safer, because when it dissolves, it produces lower amounts of free ammonia than other fertilizers.

Canadian recommendations limit the source of seed banded P to MAP, and also recommend that rates be kept at a limit of about 40 lb/acre of MAP, or about 20 lb/acre P_2O_5. Recent work at Carrington verifies these previously observed characteristics in a double-disc drill placement study (Table 3).

Table 3. Effect of seed-placed fertilizers on field pea stands using double-disc drill placement with 7-inch row spacing.

Treatment	Pea plants/acre X 1000	Yield, bu/acre
Untreated check	313.0	67.8
20 lb/acre P_2O_5, MAP	267.4	68.3
40 lb/acre P_2O_5, MAP	239.0	64.2
20 lb/acre P_2O_5, DAP	256.1	69.4
40 lb/acre P_2O_5, DAP	199.2	64.2
LSD 0.05	7.2	NS

Spreading out fertilizer with an air-seeder drill attachment may further safen seed placed application through dilution; however, rates of phosphate should be kept no higher than the levels recommended in Table 2.

Potassium, sulfur and other nutrients

If soil test levels of potassium are low, addition of potassium fertilizer would be recommended as shown in Table 2. Most fields in North Dakota are high in K, so the probability of response would be very low. Areas lower in K would tend to be sandy soils in higher landscape positions.

Sulfur deficiencies on field pea have been observed in North Dakota on sandy, eroded hillsides and hilltops under low organic matter conditions. These areas may respond to sulfur fertilizer if treated with a soluble form of sulfate supplying fertilizer. Elemental sulfur products are not generally effective in the first year of application due to a slow microbial conversion to sulfate. Treatment of entire fields with sulfur would only be recommended on low organic matter fields with low sulfur soil test levels.

No reports of responses of lentil and field pea to iron, copper, zinc, chloride, manganese or boron have been reported in North Dakota. These crops are either not sensitive to low soil levels of these nutrients, or levels of these nutrients are sufficiently supplied by the soil for these crops.

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